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A Study on the Establishment of Performance Evaluation Criteria for MR-Based Simulation Device to Train K-9 Self-Propelled Artillery Operators

Authors : Yonggyu Lee, Byungkyu Jung, Bom Yoon, Jongil Yoon

Abstract : MR-based simulation devices have been recently used in various fields such as entertainment, medicine, manufacturing, and education. Different simulation devices are also being developed for military equipment training. This is to address the concerns regarding safety accidents as well as cost issues associated with training with expensive equipment. An important aspect of developing simulation devices to replicate military training is that trainees experience the same effect as training with real devices. In this study, the criteria for performance evaluation are established to compare the training effect of an MR-based simulation device to that of an actual device. K-9 Self-propelled artillery (SPA) operators are selected as training subjects. First, MR-based software is developed to simulate the training ground and training scenarios currently used for training SPA operators in South Korea. Hardware that replicates the interior of SPA is designed, and a simulation device that is linked to the software is developed. Second, criteria are established to evaluate the simulation device based on real-life training scenarios. A total of nine performance evaluation criteria were selected based on the actual SPA operation training scenarios. Evaluation items were selected to evaluate whether the simulation device was designed such that trainees would experience the same effect as training in the field with a real SPA. To eval-uate the level of replication by the simulation device of the actual training environments (driving and passing through trenches, pools, protrusions, vertical obstacles, and slopes) and driving conditions (rapid steering, rapid accelerating, and rapid braking) as per the training scenarios, tests were performed under the actual training conditions and in the simulation device, followed by the comparison of the results. In addition, the level of noise felt by operators during training was also selected as an evaluation criterion. Due to the nature of the simulation device, there may be data latency between HW and SW. If the la-tency in data transmission is significant, the VR image information delivered to trainees as they maneuver HW might not be consistent. This latency in data transmission was also selected as an evaluation criterion to improve the effectiveness of the training. Through this study, the key evaluation metrics were selected to achieve the same training effect as training with real equipment in a training ground during the develop-ment of the simulation device for military equipment training.

Keywords : K-9 self-propelled artillery, mixed reality, simulation device, synchronization
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